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A Cost Benefit Analysis of Occupational Health and Safety at Oil and Gas Contractor Company in Indonesia

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Abstract— The oil and gas industry deals with hazardous materials, uses high-risk processes, still uses a lot of manpower, and uses large and complex equipment facilities construction. Therefore, the implementation of occupational health and safety is needed in the oil and gas industry. In this study, the development of a CBA model for the implementation of occupational safety and health will be carried out in oil and gas contractors in Indonesia by exploring the relationship between prevention costs and benefits. The aim is to see the side of the economic impact on the effective / ineffective OHS management by oil and gas contractors. This research uses quantitative and qualitative approaches. The analysis is based on these quantitative numbers. The results show that the existence of an evaluation analysis of the benefits of implementing OHS based on an economic perspective that has a significant relationship in improving working conditions is a profitable investment. Cost benefit analysis can be used as a parameter in making decisions related to occupational health and safety implementation. With the OHS CBA model, the contractor can predict the amount of cost that is issued to benefit from the implementation of occupational health and safety.

Keywords— Cost Benefit Analysis, Occupational Health and Safety, Risk management, Oil and gas contractor company

1. Introduction

The oil and gas industry is one of the most important industries because this industry produces energy to meet the increasing world energy consumption. The characteristics of the oil and gas industry are quite different from other types of industry such as the manufacturing industry or the mining industry, namely this industry has high economic risks such as during exploration which has a high risk of failure to reach the production stage and the potential for large losses of capital At the production stage, the time needed to reach the breakeven point is very long even though the profits achieved are large (Obro-Adibo, Agbodohu and Kumi, 2013; Suda et al., 2015).

On the other hand, oil or gas itself has significant dangers as well as other factors such as labor in the oil and gas industry using a lot of contractors, so for oil and gas companies there are two main concerns, namely occupational safety and health (OHS) and work ethics. Failure (risk of failures) in every work process or activity, and when a work accident, no matter how small, will result in a loss effect. According to (Cooper, 2002) that failure can be caused by human error and / or by organizational factors. One of the causes of organizational factors as the cause of work process failure is the absence of company commitment to the implementation of OHS, limitations of work regulations and procedures, and limited budget for work programs for the implementation of OHS (Gallagher, Pearse, W., 2001; Occupational Safety and Health

Administration, 2011).

The implementation of OHS is considered necessary to reduce the costs borne by workers due to an accident. A study conducted (Aven and Vinnem, 2005) on a project in an offshore company in Norway showed a savings of 22% thanks to a reduction in work accidents in the company, which with the implementation of OHS has provided a profit of US $ 750 million, not only that other benefits received. by the company, namely the reduction in complaints and occupational diseases during the last 10 years. Other research also states that the implementation of the OHS program is felt by companies to reduce production costs, loss time injury by 6.4% of total working-hours (Kjellén, Boe and Hagen, 1997). The report of the International Social Security Association Europe (2012) based on an economic evaluation of cost benefit analysis of 298 companies in 16 countries reports that 75% of companies in the UK experience real economic benefits with the implementation of an OSH management system for an average of £ 1606 with a benefit and cost ratio of 2 , 2 which means that every $ 1 invested in OHS will provide a profit of $ 2.2 to the company (ISSA, 2012). The results of the study on the implementation of the OHS management system show that the implementation of OHS is felt to provide tangible benefits in the form of reduced accident risk, risk of maintenance costs and intangible benefits such as increased productivity, labor efficiency, access to bank loans and insurance premiums, improving company image in public eye, avoiding costs related to litigation as a result of accidents and disruption of business processes, the increase in employee motivation is higher (Rzepecki, 2012; Jos Verbeek, 2017).

The existence of an evaluation analysis of the benefits of implementing OSH based on an economic perspective greatly helps employers to realize that improving working conditions can be viewed as an investment, where all economic criteria such as optimal investment expenditure, investment return period or cost-benefit analysis can be used as parameters in decision making. related to the implementation of OHS (Tompa, Dolinschi and De Oliveira, 2006; Ma, Zhao and Xi, 2016). In this study, an analysis of the costs and benefits of prevention of accidents and occupational diseases will be carried out in oil and gas sector contractors by exploring the relationship between prevention costs and benefits. The aim is to see the side of the economic impact on the effective / ineffective OHS management by oil and gas contractors.

1.1 Research Question

The lack of evidence related to the economic impact felt by companies in implementing OHS has led to investment in accident prevention as if the implementation of OHS was seen as a “cost” burden. with more and more evidence about the effect of implementing OHS on company performance, it will change the perceived cost of preventive measures by implementing an OHS Management System which was previously considered a burden, shifting into opportunities for companies. So, the research question of this study is how the correlation between the costs and benefits of work-related accident and disease prevention efforts is.

2. Method

2.1 Design Study

This research uses quantitative and qualitative approaches. The quantitative approach is carried out with the aim of correlating the cost and benefit variables. The quantitative approach is carried out at the identification stage and the estimation of costs and benefits using a questionnaire. The analysis is based on these quantitative numbers. The qualitative approach is carried out with the consideration that in the preparation of the cost and benefit components, in-depth information is needed for analysis materials. Information can be obtained through interviews involving related parties. Through interviews, it is expected that accurate information can be obtained to answer research questions.

2.2 Data Collection

Data collection was carried out by cross sectional, the questionnaire consisted of several choice questions (both dependent and independent variables). presented in the form of a Likert scale 1-5. The independent variable in this study is the cost of accident prevention while the dependent variable is the benefit from accident prevention efforts. In his approach, the independent variables will be compared to see their effect on the dependent variable. These variables are categorized into several groups. Data collection in this study was carried out by collecting primary data. Primary data is obtained through a questionnaire survey designed to obtain information related to the budget for the implementation of OHS in the company. interview with related parties such as HSE manager, HR Manager. These personnel were selected because they are responsible for OSH and safety performance in the company and are most knowledgeable about various issues regarding health and safety performance.

2.3 Data Analysis

Data analysis in this study was carried out using SPSS to obtain descriptive statistics (the most common value frequency table (mean, median and mode). Descriptive analysis is a way of describing certain situations or events, this analysis allows researchers to summarize massively the amount of data using easy to understand measure. Ratio analysis is used to obtain information about costs and benefits, baseline data is converted into ratio analysis. Correlation analysis is used to measure the strength or 'closeness' of the relationship between two variables. Correlation shows the strength and direction of the relationship between variables. Regression analysis used to explore the relationship between accident prevention costs and benefits, regression models will reveal how well accident prevention costs predict benefits.

3. Result

The results show that the respondents who filled out this questionnaire had the most experience in implementing occupational safety and health for about 6-10 years by 36%, 11-15 years by 24.3%,> 15 years by 11% and <5 years' experience by 28.8%. This shows that respondents have sufficient experience and knowledge in implementing OHS in their company. For the types of contractors who participated in this study were non-construction business oil and gas contractors by 53%, the next was construction business contractors at 27.3% and industrial business contractors at 17.5%. In the research questionnaire, respondents were also asked to name the number of employees in their company to identify the scale of the contractors in this study. The results showed that the largest number of respondents came from contractors with 50-1000 employees at 42.8%,> 1000 employees at 36% and with 0-49 employees at 21.3%. In addition, respondents were also asked to indicate the company's annual turnover. About 30.5% of respondents indicated that their company annual turnover was IDR 500,000,000,000- IDR 1,000,000,000,000. 23.3% shows that their company turnover is 101,000,000,000-IDR 200,000,000,000.00. 21% indicates the company's turnover is IDR 201,000,000,000- IDR 500,000,000,000.00. 13.8% indicated that their company had a turnover of <100,000,000,000 and 11.5% of respondents indicated their company annual turnover was> 1,000,000,000,000.00.

Table 1. Demographic characteristics

Respondents Overview	n	%
a. Work Experience		
- < 5 **years**	115	28.8%
- 6-10 **years**	144	36.0%

- 11-15 **years**	97	24.3%
- > 15 **years**	44	11%
b. **Contractor type**		
- Oil and Gas Supporting Contractor for Industrial Business	70	17.5%
- **Non-Construction** Business Oil and Gas Support Contractor	221	55.3%
- Construction Business Oil and Gas Supporting Contractor	109	27.3%
c. **Number of Permanent workers**		
- 0-49	85	21.3%
- 50-1000	171	42.8%
- > 1000	144	36%
d. Company annual turnover		
- < Rp 100.000.000.000,00	55	13.8%
- Rp 101.000.000.000,00-Rp 200.000.000.000,00	93	23.3%
- Rp 201.000.000.000,00-Rp 500.000.000.000,00		
- Rp 501.000.000.000,00- Rp 1.000.000.000.000,00	84	21.0%
- > Rp 1.000.000.000.000,00	122	30.5%
	46	11.5%

Based on the results of interviews at the supervisor, supervisor, and manager level, it shows that the average perception of OHS implementation is moderate to high. However, when viewed on staff and operator level workers, the perception of results is lower. Based on the points of assessment as mentioned above, workers at the staff level, operators must be the main concern to improve knowledge and behavior through OHS training and education, accurate information provided, and improve and constructive intensive personal communication. The supervisor level is in the interest of increasing two-way communication of personnel and the commitment to safety between supervisors and front-line workers intensively. The following is a summary of the interview.

Table 2. Interview Summary

Aspect	**Interview Summary**	
	level of supervisors, supervisors, managers	**level of staff, operators**
1. Training & Education OHS	Medium to high	Low to moderate
2. PPE		
Availability	Medium to high	moderate
Usage	High	moderate
3. MCU		
Early	High	Low to moderate
Periodically	High	Moderate
4. Environmental Measurement	Medium to high	Low to moderate
5. Equipment technology		
Replacement	Medium to high	Low to moderate
Technology updates	High	Moderate
6. Work Accident Insurance /Health Insurance		
Outreach	Medium to high	Low

Insurance information	Medium to high	Low
7. Organization		
OHS Promotion	moderate	Moderate
Commitment	moderate	low
Facility	moderate	Low to moderate
Compliance	Medium to high	Low to moderate
OHS Campaign	Moderate	Moderate
Identification, inspection	moderate	Low
OHS certification	Medium to high	Moderate

The result of this study will also look at the comparison between the costs and benefits of implementing OHS by calculating the ratio of the value of benefits to the ratio of the value of costs with the following formulations:

$$BCR=\frac{\sum_{t=0}^{n}\frac{benefit_t}{(1+i)^t}}{\sum_{t=0}^{n}\frac{Cost_t}{(1+i)^t}}=\frac{Benefit}{Cost}$$

BCR= Benefit Cost Ratio

From the formula above, then to facilitate the comparison between the total costs and benefits for the decision-making process. Then the benefit to cost ratio is calculated as follows:

$$\frac{T/_{total\ cost}}{T/_{Total\ benefit}}=\frac{Total\ benefit}{Total\ Cost}=\frac{B}{C}$$

Where B = Benefit

C = Cost

T = Turnover

Table 3. Comparison of Total Costs and Benefits of OHS Implementation

Type Contractor Oil & Gas	*Ratio total cost*	*Ratio total benefit*	*C/B*
Oil and gas contractor for industrial business	143.87	53.00	2.71
Construction business oil and gas contactors	170.22	47.00	3.62
Non-construction business oil and gas contractors	241.96	134.00	1.61

The result show that benefits of implementing OHS compared to the total costs of industrial oil and gas contractors, a value of 2: 1 is obtained where the implementation of OHS in industrial business oil and gas contractors is financially beneficial to prevent work accidents, in other words every IDR 1 budgeted for OHS implementation will be providing IDR 2 as a benefit. In the construction business oil and gas contractor, a 3: 1 1 comparison of benefits and costs is obtained where the implementation of OHS in non-construction business oil and gas contractors is financially beneficial to prevent work accidents, in other words every IDR 1 budgeted for OSH implementation will provide IDR 3 as benefits. In non-construction

business oil and gas contractors, a benefit and cost ratio of 1.6: 1 is obtained where the implementation of OHS in industrial oil and gas contractors is financially beneficial to prevent work accidents, in other words every IDR 1 budgeted for OHS implementation will provide IDR 1.6 as benefits.

4. Discussion

Our study found the ratio of every of turnover is used only (0.02%) is used to conduct training and education for industrial oil and gas contractors. Meanwhile, the construction business oil and gas contractor budgeted (0.03%) and the non-construction business oil and gas contractor budgeted (0.03%) turnover. Based on the above results, both industrial, contraction and non-industrial business oil and gas contractors have budgeted training and education costs in the same proportion. From the study can be seen that the ratio of the turnover is only used (0.02%) for the fulfilment of PPE for industrial oil and gas contractors. Meanwhile, for oil and gas contractors the construction business budgeted (0.07%) and for non-construction business oil and gas contractors budgeted (0.05%) turnover. Based on the above results there is the densest difference in the proportion of the budget for the fulfilment of PPE. For oil and gas contractors, the construction business allocates a larger proportion of the PPE budget compared to industrial oil and gas contractors and non-industrial oil and gas contractors.

The ratio of the turnover is used (0.02%) for health checks for industrial oil and gas contractors. Meanwhile, for oil and gas contractors the construction business budgeted (0.03%) for health checks and for non-construction business oil and gas contractors budgeted (0.03%) turnover for health checks. Based on the above results, both industrial, construction and non-industrial business oil and gas contractors have budgeted the cost of health checks in the same proportion. The ratio of turnover is used (0.22%) in industrial business contractors budgeted for measuring the work environment. Meanwhile, the construction business oil and gas contractors spend (0.17%) for measuring the work environment and for non-construction oil and gas contracting companies, budgeting (0.13%).

From this finding, we can see that industrial oil and gas contractors have a greater proportion in budgeting for environmental measurements compared to oil and gas contractors for construction businesses and non-construction businesses. The ratio of turnover is used (0.22%) for industrial business contractors budgeted for equipment and technology replacement. Meanwhile, for oil and gas contractors the construction business spends (0.17%) for equipment and technology and for non-construction oil and gas contracting companies, budgeting (0.13%) for equipment and technology replacement. Industrial oil and gas contractors have a greater proportion in budgeting for environmental measurements compared to oil and gas contractors for construction businesses and non-construction businesses. Ratio of turnover is used (0.69%) for organizational costs. Meanwhile, the construction business contractor budgeted the organization cost (0.59%) of turnover and the non-construction business oil and gas contractors budgeted (0.41%) of turnover for organizational costs.

Industrial oil and gas contractors budget a larger proportion for the organization compared to the construction and non-construction business oil and gas contractors. The benefits of implementing OHS in this study consist of direct benefits and indirect benefits. From the results of interviews conducted with informants, it shows that contractors need to be convinced of the business benefits they will get by investing in occupational safety and health management. Awareness of the financial benefits of implementing OHS so far is expected to encourage policy / decision makers to develop more efficient and practical safety and health management in the company. Information related to the benefits of implementing OHS was carried out by conducting interviews and providing online questionnaires. During the interview session the informant was given the opportunity to respond to a related question "based on your experience working in this company, do you think that investing in OSH Measures results in more benefits to the contractor?" Most of them answered yes, one of the informants said that "*OSH investment is a form of proactive action taken to minimize accidents in the workplace. Interestingly, in the interview session, there was an informant who said that "if in my place the OHS investment is carried out only to comply with the OHS regulations made by the government".* Another informant also argued that "*it is difficult for us to identify the costs, maybe because we lack information regarding the components for identification. , maybe if there is an application it can make it easier, huh… so we have a picture like that.* Other informants also highlighted the benefits of

implementing OHS "*I think there are more benefits associated with implementing OHS such as better employee morale, decreased fatality, reduced stress, job satisfaction compared to mere financial benefits. These benefits can be measured in terms of financial costs, but I think the benefits of implementing OHS are more than that, there are also social benefits*".

In addition, the informant also mentioned "*if there is a value or number that proves how much it costs to implement OHS to prevent accidents and how much benefit we get from this OHS investment, maybe it can be easier for us to make a budget and spend the budget for preventive measures*". This implies that some informants still do not know the potential benefits of implementing OHS. Some think that the greatest benefit is felt more due to the potential legal implications, that attention to the company's image and reputation is important. Responding to a question related to "do you think it is useful to provide information about the costs and benefits of OSH implementation to oil and gas contractors to motivate contractors to improve OHS behaviour?" The informant answered, "*If there is a tool that can measure and show there are benefits by investing in OHS, I am sure the performance of OHS can improve*". This statement implies the demonstrable potential benefits of investing in OSH can be instrumental in improving health and safety performance.

5. Conclusion

This study indicates that any expenditure on costs of accident prevention will spring - up enormous benefits to contractors' oil and gas in Indonesia. This means that the more contractors spend on accident prevention the greater the benefits they derive. These are compelling evidence that improving health and safety measures would improve health and safety performance on construction sites. It can be concluded that the cost of accident prevention significantly influences the overall benefits of construction industry. This significant found provide empirical support for the main research.

Thus, the implication of this finding is that while it might be important for contractors to have all the necessary costs of accident prevention relating to the management of health and safety issues, the costs identified are likely to enhance the achievement of higher performance of health and safety on contractor oil and gas. The analysis undertaken suggests that there is potential for contractors to improve on their health and safety performance as perceived by the respondents. It appears that on contractor health and safety management, cost is the most important consideration.

The primary reason for the success of contractor oil and gas for having greater benefit is that their management have made commitment to be safe. Without motivation from the management there is little chance that successful health and safety measures will develop. Small construction companies discovered that it is profitable to be safe. Loss of reputation, increased insurance costs, loss or potential litigation costs, working day loss, cost of sick pay, cost of compensation claim, productivity loss and cost of medical expenses are strong reasons to invest in health and safety. The relevance of benefits of accidents prevention is that it will encourage decision makers in developing efficient and practical health and safety management in the contractor oil and gas industry.

6. Conflict of Interest

The author states that there is no conflict of interest in this study

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